STEM Education across the APRU Network
Shaping Learning Experiences for Students

Moderator:
Elly Vandegrift
University of Oregon

Faculty Panelists:
Tamara Freeman
The University of British Columbia
Yasuhiro Suzuki
Nagoya University
Robert Thomson
University of Hawai‘i at Mānoa
Tim Woo
The Hong Kong University of Science and Technology

OCTOBER 9
9:00 a.m. - 10:30 a.m. (GMT+8)
ACTING TOGETHER IN THE NEW ABNORMAL

Senior International Leaders’ Week
October 6-9, 2020 (Hong Kong Time GMT+8)
• A network of 56 leading universities linking the Americas, Asia and Australasia
• Voice of Knowledge and Innovation for the Asia-Pacific region.
• We bring together thought leaders, researchers, and policy-makers to exchange ideas and collaborate on effective solutions to the challenges of the 21st century.

• Visit apru.org to learn more about our work
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Session Goals

• Learn about ways that STEM faculty in the APRU network are teaching science courses with student-centred teaching methods;

• Hear reflections from panelists on how their teaching varies across cultural and national boundaries;

• Understand the unique benefits for improved science education only accessible when one applies the model in multiple societies across diverse cultural settings;

• Hear practical approaches STEM faculty in the network have used to support learning for diverse student populations across the Pacific Rim during this time of upheaval and transformation of traditional academic environments.
How do you engage students as active participants in learning?
The Commons: Built for Active Learning
Information Literacy (for freshman)

“be a Journalist”

give knowledge & tools as an independent Journalist

- Collect information
- Evaluate
- Make a Presentation

Basic Skills of Data Science

Numerical Analysis / Natural Computing (graduate)

“be an independent scientist”

Give intuitive “tools” to do research
Evoke by attractive problems for research
(can be a scientific paper, graduate)

- evoke motivation to learn by themselves (beyond lecture),
- free from “group” or “class”
can an independent interictal

“do” science as an independent scientist

Online
Open Textbooks
(Creative
Commons License)

Y Suzuki (Nagoya U.)
In an embedded system course:

- Peer-discussion on project proposal
- In-class Q&A
- Laboratory experiments
  - After completing the laboratory experiments, you are able to integrate programming.
  - Follow the previous question, the TRI_2D of Timer 2 is connected to:
    - 1. Counter Register of Timer 1
    - 2. INT0 of Timer 1
    - 3. Counter Register of Timer 2
    - 4. INT0 of Timer 2

In-class Q&A:
You are asked to complete the circuit for measuring the timing length of events. Lastly, a brain has two different modes. Timer Mode and Counter Mode. Which of the following setting is correct?

- 1. Timer Mode, Timer Mode
- 2. Timer Mode, Counter Mode
- 3. Counter Mode, Timer Mode
- 4. Counter Mode, Counter Mode

Laboratory experiments:
Lab 1
Lab 2
Lab 3
Lab 4
Lab 5
Lab 6
Feature 1
Feature 2
Feature 3
Feature 4
Feature 5
Feature 6
Feature 7
STEAM Tutor Team

Before COVID-19

During COVID-19
Online (STEM@home video)
How do you create an inclusive learning environment for students?
HKUST Robotics Team

A family of ...
Creativity
Knowledge
Hands-on experience
Problem Solving Skills
Teamwork
Research
Ripples go beyond the competitions

Presentation competitions
- Technical
- Business
- Entrepreneur

Capstone Design Projects
- Final Year Projects
- Hobbies / Makers
- Research projects

Teaching and learning
- Junior Mentoring scheme
- Robotics x Community

Reaching out
- Friendship-exchange programs
- Public exhibitions

30 students provide 5200+ volunteering service hours
Contribute to the Community

Empower the empathy through our knowledge
Systems Thinking as a Thematic Framework: United Nations Sustainable Development Goals

UN Global Goals for Sustainable Development

Chemistry is the science of detecting, identifying, analyzing, and making molecules. A sustainable society requires that we make all the molecules we will ever need only from the molecules we will always have, which is not something we can currently achieve.

The 17 UN Global Goals for Sustainable Development are listed below. For your assigned Global Goal, work with your group to identify one way that chemistry can help us achieve it. Write your answer as one of the bullet points beside that Goal.

If your group is satisfied with your answer, or can’t think of one, do the same for a Goal with no responses yet, or for a Goal where your group thinks an important idea is missing.

For details about each Global Goal, follow this link or click on each individual graphic.

1. No poverty
   - In time like now, chemistry can allow us to find cures for the diseases that would further contribute to poverty.
   - A cause of poverty is the lack of jobs for people. Chemistry can provide various different careers such as a pharmacist.
   - “Even before COVID-19, baseline projections suggested that 6 percent of the global population would still be living in extreme poverty in 2030, missing the target of ending poverty. The fallout from the pandemic threatens to push over 70 million people into extreme poverty.”

2. Zero hunger
   - The sustainable production of food
   - Chemists have also found a way to produce synthetic protein using electricity from renewable resources using electrolysis within a bioreactor. The process is continuous and can be done anywhere regardless of environmental conditions thus it can be used to help feed people suffering from famines and starvation all around the world.
   - Chemistry can also help us conserve food for a longer time by the usage of man-made preservatives, thus leading to a higher amount of people actually receiving food rather than having it go to waste.

Create Common Language

Inclusive Learning Environment for Students

Common Language

Nature

Math. model

Qualitative things

ARMS
caterpillar → catap., catap.
carnivore + catap. → carn., carn.
carn. → (natural death)

Tactile Score

Haptic device for student w. disabilities
What benefits have your students experienced? What lessons can you share?
Contribute to the Community

Empower the empathy through our knowledge

Also there were other groups with some kind of disabilities
CHEMISTRY 1XX at UBCO

First-year chemistry courses at UBC Okanagan Campus is taught over two terms and combines two streams of students into a single course: CHEM 1XX.

- CHEM 111/113  missing GR 12, or have more than 6 years since GR 12
- CHEM 121/123  have GR 12 pre-requisite

**Figure 1:** Completion Rate by Individual Streams

**Figure 2:** Overall CHEM 1XX Completion Rate
From experience from lesson
Every student is a creative scientist; they re-invent Cellular-Automata, Fractals, Eq. of traffic jam

Drive “creativity” by evaluation criteria
What has kept you and your students inspired in 2020?
Tied-to lecture
One-direction Sequential

Try yet another Lecture style

Show some intuitive tools

Communication via home-works

Online text

Not a textbook →
text + work = a complete material

Each student chooses & uses a tool and behave as a scientist

Inspired point

Intellectuals with independence are strong

By treating as an independent Scientist,
- Strong motivation
- Well-considered questions
- High creativity

Each student does not have to be in front of PC and taking note gets tool from the text and free to explore in the universe of knowledge
COVID-19

Help slow the spread

- Wear a mask
- Wash or sanitize your hands often
- Stay 6 feet from others

Tips of Dining on Campus to Prevent COVID-19

A DEPRESSION
WE ARE UNSTOPPABLE.
We’re Unstoppable

Because the team is my family
Active Learning: Case Studies

Concept Review: electromagnetic spectrum
The electromagnetic spectrum is divided into categories of different wavelengths (\( \lambda \)), including infrared radiation, visible light, and ultraviolet light. Ultraviolet light has shorter wavelengths and higher frequencies than visible light. The frequency (\( \nu \)) of a light wave and the energy (\( E \)) of a single light photon with wavelength \( \lambda \) are given by the formula \( E = h \nu = h c / \lambda \), where \( c \) is the speed of light.

Ultraviolet light and Ozone
Ultraviolet radiation can be divided into three groups, based on how much of the light passes through the atmosphere and reaches the Earth’s surface. All UV-A light passes through the atmosphere, but most UV-B light is absorbed by stratospheric \( O_3 \), and all of UV-C light is absorbed by stratospheric \( O_3 \) and \( O_2 \). UV-B and UV-C radiation is harmful to living organisms.

7) Use the formula \( E = h \nu = h c / \lambda \) to calculate the energy range of each type of UV radiation, in units of kJmol\(^{-1}\). (Note the units of \( h \). You will need to convert from J to kJmol\(^{-1}\))

<table>
<thead>
<tr>
<th>spectrum</th>
<th>wavelength /nm</th>
<th>energy /kJmol(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>UV-A</td>
<td>315 – 400</td>
<td></td>
</tr>
<tr>
<td>UV-B</td>
<td>280 – 315</td>
<td></td>
</tr>
<tr>
<td>UV-C</td>
<td>100 – 280</td>
<td></td>
</tr>
</tbody>
</table>

Use the synthesis and replacement of each generation of refrigeration gas to illustrate the following statement: "Molecules can be both helpful and harmful."
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Teaching in Virtual Environments

APRU Global Health Program at the University of Southern California
in collaboration with
Global STEM Education Program at the University of Oregon

Save the Dates!

November 12/13
Technology for Remote Teaching

December 3/4
Authentic Online Assessment

January 21/22
Lab and Fieldwork in Remote Settings

More info or to register: apru.org/our-work/pacific-rim-challenges/global-health
Thank you
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